

ES301

AIoT Module Datasheet
BLE 5.3



Feb 2025 Ver 1.1

Professional **AIoT** Solution Provider

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1、Module Overview

1.1 Features

ITEM	SPECIFICATION		
Microcontroller	ARM Cortex-M4 CPU (Maximum 64MHz) • EFUSE:256-bit • SRAM:80kB • Serial Flash:1MB • I-Cache RAM:8KB		
Standards	• Low Energy (BLE) compliant to Bluetooth SIG v5.3		
BLE Radio	Tx Power • -30dBm to +2dBm Rx Sensitivity • 2Mbps:-96dbm • 1Mbps:-99dBm	Active Tx Power • RX mode: 3.4mA • Active TX mode:3.5mA@-20dBm • Active TX mode:4.0mA@0dBm • Active TX mode:4.5mA@2dBm • Advertising: 9uA (adv_interval:1s, payload: 23Byters,0dBm)	
Power Consumption	Deep LPS: 1.2uA(with 16K RAM retention,32KHz RC)		
Peripherals	20 x GPIO(mux'ed) 2 x SPI(master or slave) 1 x I2C(master) 8 x DMA 2 x UART	8 x Timers 8 x PWM 1 x Watchdog Timer	
Voltage	Input voltage:1.71V~3.6V, 3.3V (typical)		
Environmental	Temperature: • Operating: -30°C ~ 85°C • Storage: -40°C ~ 125°C	Humidity • Relative: < 90% Non-condensing • Storage: < 90% Non-condensing	
Physical	Dimension: 6 x 6 x 0.9 mm Weight: 0.85g	Pin: 33-pin stamp Antenna: PCB	
Certification	BQB , FCC , CE , IC , SRRC , Rohs		

1.2 Description

The ES301 is a Bluetooth 5.3 Low Energy module that merges the exceptional performance of a leading RF transceiver with a low-power ARM Cortex-M4 64MHz processor, power management unit, ADC, and intelligent I/O distribution controller. Notably, the ES301 module showcases outstanding ultra-low power performance, with broadcast power consumption as low as 9uA at a 1-second interval, and connection power consumption as low as 7uA at a 1-second interval.

The chip integrates a high-performance MCU with speeds of up to 64MHz, along with DMA, GPIO, SPI, UART, Timer, and Watchdog functionalities. It also supports a 32MHz external crystal and integrates a multi-purpose 12-bit ADC with a maximum of 12 channels. Additionally, the EH-MC26 incorporates on-chip 80K SRAM and a 256-bit EFUSE, and it supports user-defined IDE system-on-chip development with SFLASH MCU and JTAG software upgrade capabilities.

ES301 operates in host less mode, capable of running both the Bluetooth stack and applications without an external MCU. It can also be used as a BLE transceiver in hosted (HCI) mode via UART interface (AT command) with an external host running Bluetooth stacks and applications. It has undergone rigorous regulatory compliance testing and is certified with FCC, CE, IC, SRRC and environmentally compliant with RoHS and WEEE directives.

1.3 Applications

- Find My Network (Apple)
- Smart Home
- Beacon
- Smart Building
- Smart Hardware
- Electronic Tag
- Remote Control
- Industrial Automation
- Smart Toys
- Mesh

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2、 Pin Definitions

2.1 Pin Map

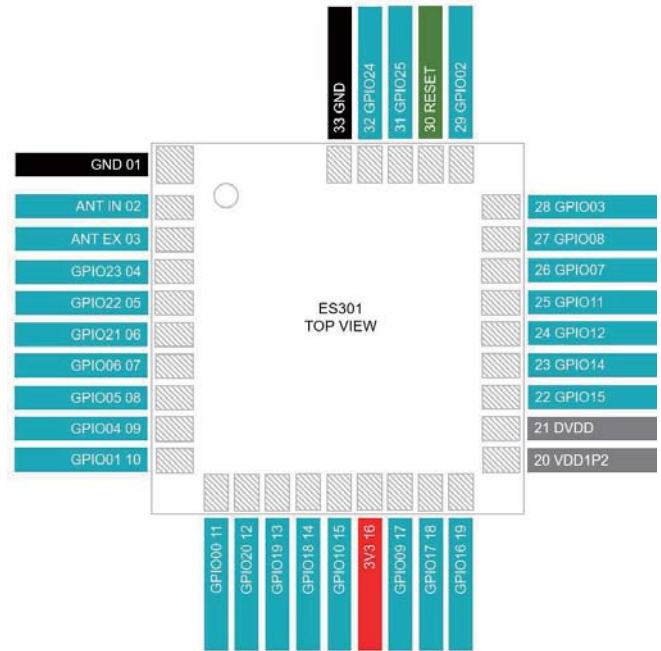


Figure2: ES301 Pin Map

2.2 Pin Definition

Pin	Pin Name	Type	Power Domain	Description
1	GND	GND	GND	Ground
2	ANT IN	ANT	–	RF Port
3	ANT EX	ANT	–	RF Port
4	GPIO23	DIO	PWR	Digital GPIO
5	GPIO22	DIO	PWR	Digital GPIO
6	GPIO21	DIO	PWR	Digital GPIO
7	GPIO06	DIO	PWR	Digital GPIO06 / UART_RX
8	GPIO05	DIO	PWR	Digital GPIO05 / UART_TX
9	GPIO04	DIO	PWR	Digital GPIO04 / BOOT
10	GPIO01	DIO	PWR	Digital GPIO
11	GPIO00	DIO	PWR	Digital GPIO
12	GPIO20	DIO	PWR	Digital GPIO
13	GPIO19	DIO	PWR	Digital GPIO
14	GPIO18	DIO	PWR	Digital GPIO
15	GPIO10	DIO	PWR	Digital GPIO
16	3V3	PWR	–	Power Input (1.71~3.6V)
17	GPIO09	DIO	PWR	Digital GPIO
18	GPIO17	DIO	PWR	Digital GPIO
19	GPIO16	DIO	PWR	Digital GPIO
20	VDD1P2	DIO	PWR	Digital GPIO
21	DVDD	DIO	PWR	Digital GPIO
22	GPIO15	DIO	PWR	Digital GPIO
23	GPIO14	DIO	PWR	Digital GPIO
24	GPIO12	DIO	PWR	Digital GPIO
25	GPIO11	DIO	PWR	Digital GPIO
26	GPIO07	DIO	PWR	Digital GPIO
27	GPIO08	DIO	PWR	Digital GPIO
28	GPIO03	DIO	PWR	Digital GPIO
29	GPIO02	DIO	PWR	Digital GPIO

Pin	Pin Name	Type	Power Domain	Description
30	RESET	DIO	PWR	RESET
31	GPIO25	DIO	PWR	Digital GPIO
32	GPIO24	DIO	PWR	Digital GPIO
33	GND	GND	GND	Ground

Table2: Pin Definition

2.3 IO Pin Mux

Table

GPIO	timer0/1/2 cap/pwm	timer0/1/2 pwm-n	timer0/1/2 input	le timer	uart0	uart1	spi0/1	i2c0	sflash controller	tx_ext_pd rx_ext_pd	pta
GPIO00	timer1_out[3]		timer2_etr	le_timer_out0	uart0_out		i_spi0_sda	i2c_sck			
GPIO01	timer1_out[2]	timer2_outn[0]	timer0_etr	le_timer_out1	uart0_in	i_uart1_ctsn	spi0_sdio	i2c_sda			pta_active_in
GPIO02	timer1_out[1]	timer2_outn[1]	timer0_bkin	le_timer_out0	uart0_out	o_uart1_rtsn	spi0_csn	i2c_sck		tx_ext_pd	pta_active_in
GPIO03	timer1_out[0]	timer2_outn[2]	timer0_etr	le_timer_out1	uart0_in	i_uart1_sda	spi0_sck	i2c_sda		rx_ext_pd	pta_active_out
GPIO04	timer0_io[0]		timer1_etr	le_timer_out0	uart0_out	o_uart1_sda	i_spi1_sda	i2c_sck		tx_ext_pd	pta_priority
GPIO05	timer0_io[1]	timer1_outn[0]	timer2_bkin	le_timer_out1	uart0_out	o_uart1_sda	spi1_sdio	i2c_sda		rx_ext_pd	pta_freq
GPIO06	timer0_io[2]	timer1_outn[1]	timer2_etr	le_timer_out0	uart0_in	i_uart1_sda	spi1_csn	i2c_sck		tx_ext_pd	pta_active_in
GPIO07	timer0_io[3]	timer1_outn[2]	timer2_bkin	le_timer_out1	uart0_in	i_uart1_ctsn	spi1_sck	i2c_sda	sflash_so	rx_ext_pd	pta_active_out
GPIO08	timer2_out[0]		timer0_bkin	le_timer_out0	uart0_out	o_uart1_rtsn	i_spi0_sda	i2c_sck	sflash_csn_1	tx_ext_pd	pta_priority
GPIO09	timer2_out[1]	timer0_outn[0]	timer1_bkin	le_timer_out1	uart0_in	i_uart1_sda	spi0_sdio	i2c_sda	sflash_ck	rx_ext_pd	pta_freq
GPIO10	timer2_out[2]	timer0_outn[1]	timer1_etr	le_timer_out0	uart0_out	o_uart1_sda	spi0_csn	i2c_sck	sflash_si	tx_ext_pd	pta_active_in
GPIO11	timer2_out[3]	timer0_outn[2]	timer1_bkin	le_timer_out1	uart0_in	i_uart1_ctsn	spi0_sck	i2c_sda	sflash_hd	rx_ext_pd	pta_active_out
GPIO12	timer1_out[0]		timer2_etr	le_timer_out0	uart0_out	o_uart1_rtsn	i_spi1_sda	i2c_sck	sflash_wp	tx_ext_pd	pta_priority
GPIO13	timer1_out[1]	timer2_outn[0]	timer0_etr	le_timer_out1	uart0_in	i_uart1_sda	spi1_sdio	i2c_sda		rx_ext_pd	pta_freq
GPIO14	timer1_out[2]	timer2_outn[1]	timer0_bkin	le_timer_out0	uart0_out	o_uart1_sda	spi1_csn	i2c_sck		tx_ext_pd	pta_active_in
GPIO15	timer1_out[3]	timer2_outn[2]	timer0_etr	le_timer_out1	uart0_in	i_uart1_ctsn	spi1_sck	i2c_sda		rx_ext_pd	pta_active_out
GPIO16	timer0_io[0]		timer1_etr	le_timer_out0	uart0_out	o_uart1_rtsn	i_spi0_sda	i2c_sck		tx_ext_pd	pta_priority
GPIO17	timer0_io[1]	timer1_outn[0]	timer2_bkin	le_timer_out1	uart0_in	i_uart1_sda	spi0_sdio	i2c_sda		rx_ext_pd	pta_freq
GPIO18	timer0_io[2]	timer1_outn[1]	timer2_etr	le_timer_out0	uart0_out	o_uart1_sda	spi0_csn	i2c_sck		tx_ext_pd	pta_active_in
GPIO19	timer0_io[3]	timer1_outn[2]	timer2_bkin	le_timer_out1	uart0_in	i_uart1_ctsn	spi0_sck	i2c_sda		rx_ext_pd	pta_active_out
GPIO20	timer2_out[0]		timer0_bkin	le_timer_out0	uart0_out	o_uart1_rtsn	i_spi1_sda	i2c_sck		tx_ext_pd	pta_priority
GPIO21	timer2_out[1]	timer0_outn[0]	timer1_bkin	le_timer_out1	uart0_in	i_uart1_sda	spi1_sdio	i2c_sda		rx_ext_pd	pta_freq
GPIO22	timer2_out[2]	timer0_outn[1]	timer1_etr	le_timer_out0	uart0_out	o_uart1_sda	spi1_csn	i2c_sck		tx_ext_pd	pta_active_in
GPIO23	timer2_out[3]	timer0_outn[2]	timer1_bkin	le_timer_out1	uart0_in		spi1_sck	i2c_sda		rx_ext_pd	pta_active_out
GPIO24	timer0_io[0]	timer0_outn[1]	timer0_etr	le_timer_out0	uart0_out	i_uart1_sda	i_spi0_sda	i2c_sck		tx_ext_pd	pta_priority
GPIO25	timer0_io[1]	timer0_outn[0]	timer0_bkin	le_timer_out1	uart0_in	o_uart1_sda	spi0_sdio	i2c_sda		rx_ext_pd	pta_freq

Table3: IO Pin Mux Table

3、Electrical Characteristics

3.1 Absolute Maximum Ratings

The absolute maximum ratings provided in this section reflect the stress levels that, if exceeded, may cause permanent damage to the device. No functionality is guaranteed outside the operating specifications. Functionality and reliability are only guaranteed within the operating.

Parameter	Min	Typ	Max	Unit
Supply voltage (VCC)	-0.3	-	3.9	V
Maximum Junction Temperature	-40	-	125	°C
Storage Temperature	-40	-	125	°C

Table4: Absolute Maximum Ratings

3.2 Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit
Operating ambient temperature	-30	-	85	°C
Supply Voltage(VCC)	1.71	3.3	3.6	V
I/O supply Voltage	1.8	-	VDD_BAT	V
Frequency range	2402	-	2480	MHz

Table5: Recommended Operating Conditions

3.3 Power Consumption

The current consumption measurements are taken with a 3.3V supply at 25 °C of ambient temperature at the RF port. All transmitters' measurements are based on 100% duty cycle.

Work Mode	Description		Peak(mA)
Active (RF working)	RX		3.4mA
	TX	TX Power:-30dBm	3.5mA
		TX Power:0dBm	4.2mA
		TX Power:+2dBm	6.0mA
	Beacon	Adv_interval: 1S, payload: 23Bytes, 0dBm	9uA

Table6: Active Mode Power Consumption

Minimum power consumption: Condition: VCC=3.3V, ambient temperature:25°C

Parameter	32kHz RCOSC	Retention SRAM	Wake-up	Current Consumption (Typical)
Power Down	Off	Off	Wake-up by GPIO	0.9uA

Parameter	32kHz RCOSC	Retention SRAM	Wake-up	Current Consumption (Typical)
Sleep Mode	On	Retention	Wake-up by GPIO	1.7uA

Table7: Low Power Mode Power Consumption

4 Radio Performance

Parameter	Bandwidth	Modulation	Rate	Type	Unit
Tx Power	2MHz	GFSK	1Mbps	+2	dBm
			2Mbps	+2	dBm
Rx Sensitivity			1Mbps	-99	dBm
			2Mbps	-96	dBm

Table8: BLE Radio Characteristics

5、Peripheral Schematics

The module uses the internal antenna and the external antenna simple reference design schematic:

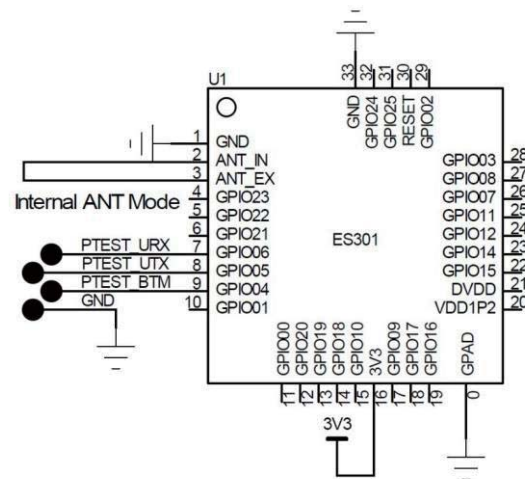


Figure 3: ES301 Schematic Diagram of Internal Antenna

6、 Mechanical Specification

6.1 Dimensional View

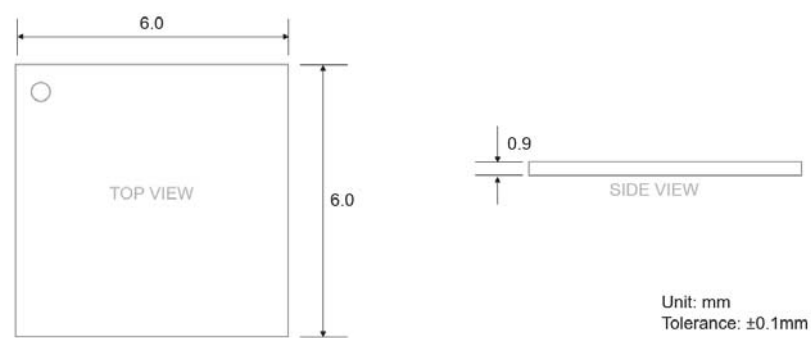


Figure 5: ES301 Physical Dimensions

6.2 Recommended PCB Land Pattern

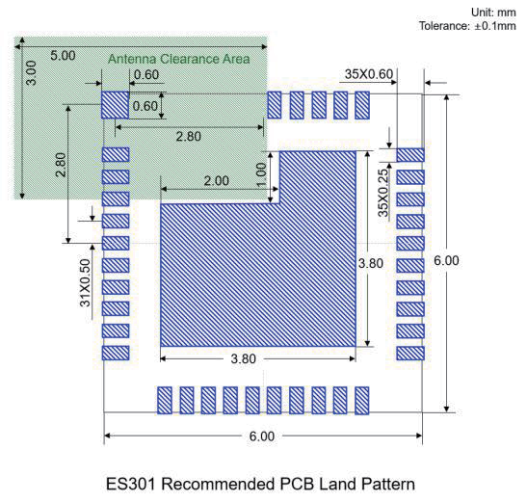


Figure 6: ES301 Recommended PCB Land Pattern

7、Product Handling

7.1 Storage Conditions

7.1.1 The products sealed in moisture barrier bags (MBB) should be stored in a non-condensing atmospheric environment of $< 40^{\circ}\text{C}$ and $/90\%\text{RH}$. The module is rated at the moisture sensitivity level (MSL) of 3.

7.1.2 After unpacking, the module must be soldered within 168 hours with the factory conditions $25\pm 5^{\circ}\text{C}$ and $/60\%\text{RH}$. If the above conditions are not met, the module needs to be baked.

7.2 Electrostatic Discharge (ESD)

7.2.1 Human body model (HBM): $\pm 2000\text{ V}$

7.2.2 Charged-device model (CDM): $\pm 500\text{ V}$

7.3 Reflow Profile

Solder the module in a single reflow.

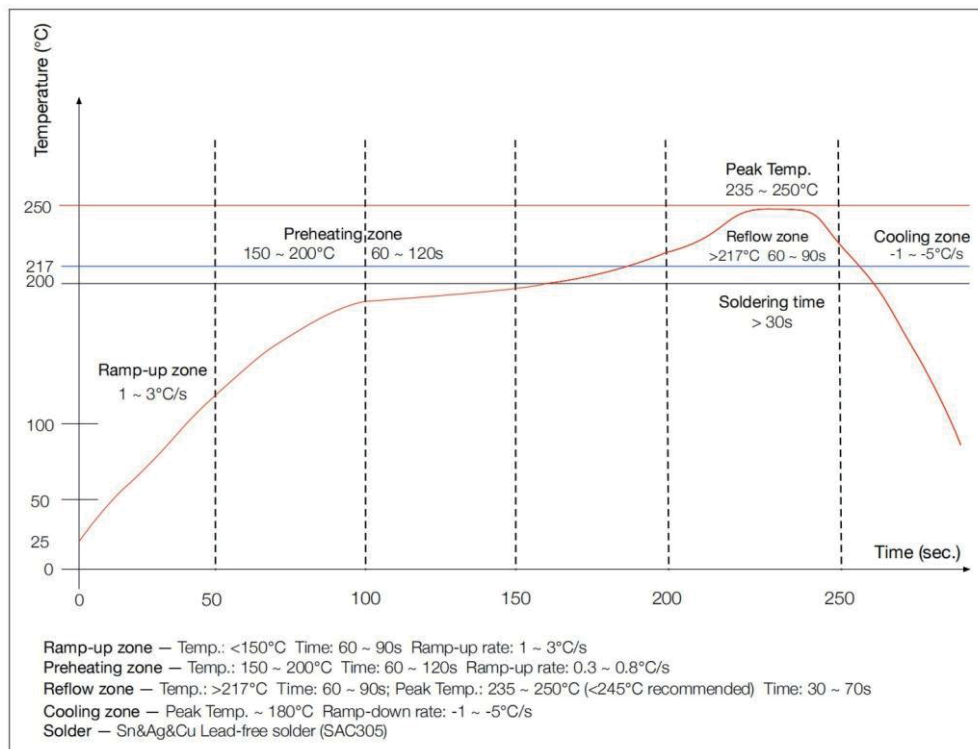


Figure 9: Reflow Profile

7.4 Ultrasonic Vibration

Avoid exposing Ehong modules to vibration from ultrasonic equipment, such as ultrasonic welders or ultrasonic cleaners. This vibration may induce resonance in the in-module crystal and lead to its malfunction or even failure. As a consequence, the module may stop working or its performance may deteriorate.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM

Manual v01r01 List of applicable FCC rules:

FCC Part 15 Subpart C 15.247 & 15.207 & 15.209

Specific operational use conditions:

The module is a BLE Module with BLE function. Operation Frequency: 2402-2480MHz

Number of Channel: 40 Modulation: GFSK

Type: Ceramic Antenna (0.21dBi)

The module can be used for mobile applications with a maximum 0.21dBi antenna. The host manufacturer installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

Trace antenna designs

Not applicable. The module has its own antenna, and doesn't need a host's printed board microstrip trace antenna etc.

RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users' body; and If RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Antenna

Antenna Specification are as follows: ES301 (Ceramic Antenna)

This device is intended only for host manufacturers under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the internal antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique' antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.)

Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID: 2ACCRES301" with their finished product.

Information on test modes and additional testing requirements

Operation Frequency: 2402-2480MHz Number of Channel: 40

Modulation: GFSK

Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.207 & 15.209 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Federal Communication Commission Statement (FCC, U.S.)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful

interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTES

Co-location warning:

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM integration instructions:

This device is intended only for OEM integrators under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as the conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End product labeling:

The final end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ACCRES301” .

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

ISED Statement

English: This device complies with Innovation, Science and Economic Development license - exempt RSS standard(s).

Operation is subject to the following two conditions: (1) This device may not cause interference, and (2) This device must accept any interference, including interference that may cause undesired operation of the device. The digital apparatus complies with Canadian CAN ICES - 3 (B)/NMB - 3(B).

French: Le présent appareil est conforme aux CNR d'Innovation, Science et développement économique applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This radio transmitter has been approved by Innovation, Science and Economic Development to operate with the antenna types listed with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio a été approuvé par Innovation, Science et développement économique pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Radiation Exposure Statement

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Déclaration d'exposition aux radiations

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20cm entre le radiateur et votre corps.

This device is intended only for OEM integrators under the following condition:

The transmitter module may not be co-located with any other transmitter or antenna.

As long as the condition above is met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 1 condition ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate

Canada authorization.

Note Importante:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l' IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

The final end product must be labeled in a visible area with the following: Contains IC: 20625-ES301. Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: Contient des IC: 20625-ES301

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual. Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

This radio transmitter ISSED Number: 20625-ES301 has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device

This module is a system on chip module, but it also can be integrated into a host system with any processor in consumer or industry area with uart communication interface to run common ble functionality.

10 、 Related Documentation and Resources

10.1 Ehong Documents

Visit website and download:

<https://www.ehonglink.com/h-pd-466.html>

Supports: support@ehonglink.com

Sales: sales@ehonglink.com

Phone: +0086 021-64769993-201

10.2 Revision History

Data	Version	Release notes
2024-11-04	V1.0	Preliminary Release
2025-2-05	V1.1	Optimize reference design
2025-04-03	V1.2	Update the antenna pattern